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ABSTRACT

The American College Testing (ACT) Program's Collegiate Assessment of Academic Proficiency (CAAP) was chosen as Arkansas' "rising junior exam" to measure learning in the general education curriculum. A study was conducted with a group of 124 college students to determine the predictability of CAAP scores based on ACT scores and cumulative grade point averages (GPAs), individually and together. Both Pearson's "r" and Spearman's "r" were used in determining correlation between ACT scores and CAAP scores and between cumulative GPAs and CAAP scores. The study found statistically significant correlations at the 0.001 level between ACT scores and corresponding CAAP scores and between CAAP scores and cumulative GPAs. There was significant predictability between the ACT scores and CAAP scores. Sixty percent of the variation in CAAP writing skills scores, 30% of the variation in CAAP mathematics scores, 58% of variation in CAAP reading scores, and 52% of variation in CAAP science reasoning scores were accounted for by corresponding ACT scores. Predictability was weaker when estimating CAAP scores based solely on cumulative GPAs. The study found that the combined forces of the two independent variables (ACT scores and cumulative GPAs) accounted for the following proportions of variations in CAAP scores: 64% for writing skills, 38% for mathematics, 58% for reading, and 58% for science reasoning. For future studies, using the CAAP as pretest and posttest is recommended so that any changes could be more aptly attributed to the treatment (45 to 60 hours of general education). (Contains three tables, eight figures, and eight references.) (Author/SLD)

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Prediction of CAAP Scores Based on ACT Scores, Cumulative GPA's, and Both

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Abstract

The CAAP exam was chosen to serve as Arkansas' "rising junior exam" to measure learning in the general education curriculum. A study was conducted on a group of 124 students at the University of Arkansas at Monticello (UAM) to determine the predictability of CAAP scores based on ACT scores, cumulative GPA's, and both.

Both Pearson's r and Spearman's r_s were used in determining correlation between ACT scores and CAAP scores and between cumulative GPA's and CAAP scores. The study found statistically significant correlations at the .001 level between ACT scores and corresponding CAAP scores and between CAAP scores and cumulative GPA's.

There was significant predictability between the ACT scores and CAAP scores; specifically, 60% of variation in CAAP writing skills scores, 30% of variation in CAAP mathematics scores, 58% of variation in CAAP reading scores, and 52% of variation in CAAP science reasoning scores were accounted for by the corresponding ACT scores. Predictability was weaker when estimating CAAP scores based solely on cumulative GPA's. The study found that the combined forces of the two independent variables (ACT scores and cumulative GPA's) accounted for the following proportions of variations in CAAP scores: 64% for writing skills, 38% for mathematics, 58% for reading, and 58% for science reasoning.

One recommendation of this study was to use the CAAP as a pretest and posttest so that any changes could be more aptly attributed to the treatment (45-60 hours of general education).

Prediction of CAAP Scores Based on ACT Scores, Cumulative GPA's, and Both

INTRODUCTION

The Arkansas General Assembly in its 1993 regular session passed Act 874 to establish a rising junior test to be used at the state's public colleges and universities to measure learning in the general education curriculum. Following an Arkansas Department of Higher Education (ADHE) committee review of three possible instruments--Educational Testing Service's Academic Profile, American College Testing's Collegiate Assessment of Academic Proficiency (CAAP), and Riverside Publishing's College Base--the CAAP was chosen.

The same ADHE committee had already established guidelines for what was termed the "Arkansas Assessment of General Education (AAGE)." Under these guidelines, the chosen test (the CAAP) would be administered during designated testing weeks in April and November to students having earned 45-60 hours at the freshman-level or above. Each state institution would be required to administer the examination at least three times during the week to accommodate students' schedules. Four CAAP modules (writing skills, mathematics, reading, and science reasoning) were to be given in exactly the same order by all institutions. The committee specified that the examination would not have cutoff scores to restrict a student's progress but that a statement would be posted on each student's transcript that he/she had completed the assessment. The

penalty for not complying with the law was "interruption of enrollment," which basically meant the student could not enroll again until the testing requirement was met.

At the time that Act 874 was passed, the intention was for the results to be used in allocating performance/productivity funding.* Statewide testing has been conducted according to the ADHE guidelines since the first testing in April 1995.

The testing requirement in Arkansas was really not surprising considering that other states had already taken similar stances. For example, Florida legislation effective August 1, 1984, required students to pass an exit exam to advance past the sophomore year (Losak, 1986). Another example is the University System of Georgia, which began using testing in the mid-1970's. While passage of the Georgia Regents' Test is not required for admission to upper-division course work, failure requires remediation, and passage is necessary for graduation. The state of Tennessee requires the seniors in its public colleges and universities to take the ACT-COMP examination, with results serving as a basis for performance funding (Lenth, 1993).

Former Secretary of Education William Bennett once stated that " . . . many of our graduates do not seem to possess the knowledge, skills, and in some cases the character and civic virtues that should constitute a highly educated person" (Florida, 1989, p. 7). The National Education Goals Panel (NEGP), which was formed in July 1990 following President Bush's Education Summit the year before, advanced the quality statement that college graduates should be able to think critically, communicate effectively, and solve problems. Even though there is no common core of courses offered in America's

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*Since the Act was passed, the state has had a change in governors, and a new funding formula for higher education is being developed.

colleges and universities, the NEGP, nevertheless, worked under the assumption that undergraduate education teaches students a common body of knowledge and that there are instruments readily available to measure that common knowledge (Ratcliff, 1993, pp. 59-60).

Today's standardized tests are apparently weak in determining changes in student learning that take place because of educational experiences. Banta said that testing programs can even be a factor in lowering academic standards to a level which can be easily assessed (Banta, 1993, p. 43). Gardner noted that a multitude of factors affect performance on a test and that a single test score cannot possibly reflect all the elements which influenced it (Gardner, 1989). Astin pointed out that students who have the best grades and the highest test scores at the time of entry will also perform better on posttests, even if no learning were to take place (Astin, 1990, p. 468).

The problem of this study was to assess whether the CAAP test was serving its intended goal (to measure learning in the general education curriculum) or whether it was a reflection of prior performance (ACT scores) or postsecondary performance (cumulative GPA's) or both. This was particularly important not only because institutions were likely to be financially impacted by the results but also because of the intriguing possibility that CAAP scores could be predicted based on incoming ACT scores, cumulative GPA's, or both.

METHOD

This study was conducted during the spring of 1997 using the most recent (November 1996) set of CAAP scores of students from the University of Arkansas at

Monticello, a rural, comprehensive institution with an enrollment of approximately 2,200. Rather than taking a sample of scores from the November 1996 testing, the scores from the entire population of 124 examinees was included.

Both Pearson's r and Spearman's r_s tests were used in determining correlation between ACT scores and CAAP scores and between cumulative GPA's and CAAP scores. Linear regression models were generated for analyzing predictability of CAAP scores based on ACT scores, cumulative GPA's, and both. All hypotheses were tested individually at the .001 level of significance to achieve an overall significance level of .05.

Both ACT and CAAP scores are scaled. ACT scores range from 1 to 36, CAAP total scores (e.g., mathematics) range from 40-80, and CAAP subscores (e.g., algebra) range from 5-25 (American College Testing, 1995, 8).

RESULTS

Correlation Between ACT Scores and CAAP Scores

The null hypothesis was that there was no significant correlation at the .001 level between the ACT scores and the corresponding CAAP scores. The following correlation coefficients were obtained:

	Pearson's r	Spearman's r_s
ACT English scores and CAAP Writing Skills scores	.7804 p=.000 (2-tailed sig.)	.7645 p=.001 (1-tailed sig.)
ACT Mathematics scores and CAAP Mathematics scores	.5556 p=.000 (2-tailed sig.)	.4961 p=.001 (1-tailed sig.)
ACT Reading scores and CAAP Reading scores	.7665 p=.000 (2-tailed sig.)	.7571 p=.001 (1-tailed sig.)

	Pearson's *r*	Spearman's *r*,
ACT Science Reasoning scores and CAAP Science Reasoning scores	.7260 p=.000 (2-tailed sig.)	.7249 p=.001 (1-tailed sig.)

In each of the four areas, sufficient evidence existed to reject the null hypothesis. The least amount of correlation was that between ACT mathematics scores and CAAP mathematics scores. The other three areas indicated a substantial amount of positive correlation.

Prediction of CAAP Scores Based on ACT Scores

Regression plots and statistics were generated using the CAAP scores as the dependent (predicted) variable and the corresponding ACT scores as the independent (predictor) variable. In each instance, assumptions for regression (independence, linearity, normality, and homoscedasticity) were considered and satisfied. The independence assumption was already tenable, since all of the ACT scores were independent of each other, as were the CAAP scores. Also, no individual score was included more than once.

The null hypothesis was that there was no linear relationship at the .001 level between ACT scores and the corresponding CAAP scores; i.e., the correlation coefficient was zero.

While there were 124 students tested, there were fewer matched pairs of scores. This was because some students entered with other entrance scores (SAT or ASSET) or opted to begin at the developmental level and did not have ACT scores on record.

Regression plots and statistics are shown in Figures I, II, III, and IV. The following is a summary of the findings:

Prediction of . . .	Correlation Coefficient/ Significance	Adjusted R Squared	% of Variation in CAAP Scores Not Accounted for by ACT Scores
CAAP Writing Skills scores based on ACT English scores (n=108). Shown in Figure I. Regression Equation: 46.85+(.80*ACT English score) = Predicted CAAP Writing Skills score	.78038/.0000	.60531	40%
CAAP Mathematics scores based on ACT Mathematics scores (n=108). Shown in Figure II. Regression Equation: 47.77+(.46*ACT Mathematics score) = Predicted CAAP Mathematics score	.55564/.0000	.30222	70%
CAAP Reading scores based on ACT Reading scores (n=109). Shown in Figure III. Regression Equation: 46.08+(.71*ACT Reading score) = Predicted CAAP Reading score	.76650/.001	.58367	42%
CAAP Science Reasoning scores based on ACT Science Reasoning scores (n=107). Shown in Figure IV. Regression Equation: 45.99+(.70*ACT Science Reasoning score) = Predicted CAAP Science Reasoning score	.725999/.001	.52256	48%

CAAP scores could be reasonably predicted based on corresponding ACT scores. It was apparent that the best prediction was that for CAAP writing skills based on ACT English scores, while the weakest was that for CAAP mathematics scores based on ACT

mathematics. The null hypothesis that there was no linear relationship had to be rejected in all four areas.

Correlation Between Cumulative GPA's and CAAP Scores

GPA's at the University of Arkansas at Monticello are measured on a 4-point scale (A=4, B=3, C=2, D=1, F=0). The null hypothesis was that there was no significant correlation at the .001 level between cumulative GPA's and CAAP scores.

The following correlation coefficients were obtained:

	Pearson's *r*	Spearman's *r*,
Cumulative GPA's and CAAP Writing Skills scores	.5161 p=.000 (2-tailed sig.)	.4865 p=.001 (1-tailed sig.)
Cumulative GPA's and CAAP Mathematics scores	.4346 p=.000 (2-tailed sig.)	.4143 p=.001 (1-tailed sig.)
Cumulative GPA's and CAAP Reading scores	.4136 p=.000 (2-tailed sig.)	.3681 p=.001 (1-tailed sig.)
Cumulative GPA's and CAAP Science Reasoning scores	.4382 p=.000 (2-tailed sig.)	.3992 p=.001 (1-tailed sig.)

Cumulative GPA's and CAAP scores were not as closely correlated as were ACT scores and CAAP scores. Still, there was moderate significant correlation between cumulative GPA's and the scores of each CAAP module. The greatest correlation was that between cumulative GPA's and CAAP writing skills scores. Cumulative GPA's and CAAP reading scores had the least correlation. In each of the four areas, sufficient evidence existed to reject the null hypothesis.

Prediction of CAAP Scores Based on Cumulative GPA's

Regression plots and statistics were generated using the CAAP scores as the dependent (predicted) variable and the cumulative GPA's as the independent (predictor) variable. Assumptions for regression were considered and were found to be satisfied. The null hypothesis was that there was no linear relationship at the .001 level between cumulative GPA's and CAAP scores; i.e., the correlation coefficient was zero. Regression plots and statistics are given in Figures V, VI, VII, and VIII.

Prediction of . . .	Correlation Coefficient/ Significance	Adjusted R Squared	% of Variation in CAAP Scores Not Accounted for by Cumulative GPA's
CAAP Writing Skills scores based on cumulative GPA's (n=124). Shown in Figure V. Regression Equation: 48.87+(4.90*cumulative GPA) = Predicted CAAP Writing Skills score	.51610/.001	.26035	74%
CAAP Mathematics scores based on cumulative GPA's (n=124). Shown in Figure VI. Regression Equation: 49.11+(2.52*cumulative GPA) = Predicted CAAP Mathematics score	.43461/.001	.18224	82%
CAAP Reading scores based on cumulative GPA's (n=124). Shown in Figure VII. Regression Equation: 48.58+(4.37*cumulative GPA) = Predicted CAAP Reading score	.41363/.000	.16429	84%

Prediction of . . .	Correlation Coefficient/ Significance	Adjusted R Squared	% of Variation in CAAP Scores Not Accounted for by Cumulative GPA's
CAAP Science Reasoning scores based on cumulative GPA's (n=124). Shown in Figure VIII. Regression Equation: 50.06+(3.52*cumulative GPA) = Predicted CAAP Science Reasoning score	.43820/.001	.18539	81%

There was a linear relationship at the .001 level between each of the CAAP scores and cumulative GPA's. While CAAP scores could be predicted based on cumulative GPA's, the predictions were not nearly as strong as those which were based on ACT scores.

Prediction of CAAP Scores Based on ACT Scores and Cumulative GPA's

Multiple regression plots and statistics were generated using the CAAP score as the dependent (predicted) variable and a combination of the corresponding ACT score and cumulative GPA as the independent (predictor) variables. Regression assumptions were assessed and found to be satisfied.

To help recognize the presence of multicollinearity, variance inflation factors were computed for all regression models. No variance inflation factor was greater than 10 for any group of scores, so multicollinearity was not considered to be a threat to any of the results.

The null hypothesis was that there was no linear relationship at the .001 level between ACT scores, cumulative GPA's and CAAP scores; i.e., the correlation coefficient was zero.

Prediction of CAAP writing skills scores based on ACT English scores and cumulative GPA's. Regression statistics for the group (108 matched records) were:

Multiple R	.80363
R Square	.64582
Adjusted R Square	.63907
Standard Error	2.82440

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	1527.30482	763.65241
Residual	105	837.61184	7.97726

F = 95.72871 Signif F = .0000

Variable	B	SE B	Beta	T	Sig T
Cumulative GPA's	2.075477	.628173	.219016	3.304	.0013
ACT English	.692758	.068051	.674810	10.180	.0000
(Constant)	43.158625	1.656391		26.056	.0000

On the basis of the F significance, there was evidence to reject the null hypothesis that there was no linear relationship between CAAP writing skills scores and a combination of ACT English scores and cumulative GPA's. At least one of the two independent variables was a significant predictor of CAAP writing skills scores. This is supported by the significance levels of the t ratios (.0000 for ACT English scores and .0013 for cumulative GPA's).

Prediction of CAAP mathematics scores based on ACT mathematics scores and cumulative GPA's. The regression statistics for the group were:

Multiple R	.62198
R Square	.38686
Adjusted R Square	.37518
Standard Error	2.27491

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	342.85283	171.42641
Residual	105	543.39717	5.17521

F = 33.12453 Signif F = .0000

Variable	B	SE B	Beta	T	Sig T
Cumulative GPA's	1.711104	.467827	.294960	3.658	.0004
ACT Mathematics	.386080	.067480	.461393	5.721	.0000
(Constant)	44.376288	1.506245		29.462	.0000

Based on the significance of F, the null hypothesis was rejected.

Prediction of CAAP reading scores based on ACT reading scores and cumulative GPA's. Regression statistics for the group (109 matched records) were:

Multiple R	.76775
R Square	.58943
Adjusted R Square	.58169
Standard Error	3.44953

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	1810.82451	905.41225
Residual	106	1261.32228	11.89927

F = 76.08975 Signif F = .0000

Variable	B	SE B	Beta	T	Sig T
Cumulative GPA	.535659	.763636	.050223	.701	.4846
ACT Reading	.686549	.066277	.741673	10.359	.0000
(Constant)	45.045726	1.923469		23.419	.0000

Based on the F significance, there appeared to be a linear relationship between CAAP reading scores and a combination of ACT reading scores and cumulative GPA's, thus providing evidence to reject the null hypothesis. While at least one of the dependent variables was a significant predictor, it did not appear to be cumulative GPA.

Prediction of CAAP science reasoning scores based on ACT science reasoning scores and cumulative GPA's. For the group (n=107 matched records), there was a correlation of .76391 between the dependent and independent variables, and it was significant at the .001 level. According to the significances of the t ratios, both independent variables were significant predictors of CAAP science reasoning scores. The null hypothesis was rejected. Regression statistics were:

Multiple R	.76391
R Square	.58356
Adjusted R Square	.57556
Standard Error	2.63473

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	1011.68122	505.84061
Residual	104	721.94495	6.94178

F = 72.86902 Signif F = .0000

Variable	B	SE B	Beta	T	Sig T
Cumulative GPA's	2.061252	.548751	.254013	3.756	.0003
ACT science reason.	.612692	.065104	.636407	9.411	.0000
(Constant)	41.922178	1.663358		25.203	.0000

Summary. The following is a summary of the prediction of CAAP scores based on a combination of ACT scores and cumulative GPA's:

Prediction of . . .	Correlation Coefficient/ Significance	Adjusted R Squared	% of Variation in CAAP Scores Not Accounted for by ACT Scores and Cumulative GPA's
CAAP Writing Skills scores based on ACT English scores and cumulative GPA's (n=108). Regression Equation: 43.16+(.69*ACT English score)+(2.08*cumulative GPA) = Predicted CAAP Writing Skills score	.80363/.0000	.64	36%
CAAP Mathematics scores based on ACT mathematics scores and cumulative GPA's (n=108). Regression Equation: 44.38+(.39*ACT Mathematics score)+(1.71*cumulative GPA) = Predicted CAAP Mathematics score	.62198/.0000	.38	62%
CAAP Reading scores based on ACT Reading scores and cumulative GPA's (n=109). Regression Equation: 45.05+(.69*ACT Reading score)+(.54*cumulative GPA) = Predicted CAAP Reading score.	.76775/.0000	.58	42%
CAAP Science Reasoning scores based on ACT Science Reasoning scores and cumulative GPA's (n=107). Regression Equation: 41.92+(.61*ACT Science Reasoning score)+(2.06*cumulative GPA) = Predicted CAAP Science Reasoning score	.76391/.001	.58	42%

CONCLUSIONS AND RECOMMENDATIONS

There was evidence that the CAAP scores were, in some respects, a reflection of students' ACT scores. This was based on statistically significant correlations between ACT scores and corresponding CAAP scores. Because of this relationship, there was some degree of predictability between the scores; specifically, 60% of variation in CAAP writing skills scores, 30% of variation in CAAP mathematics scores, 58% of variation in CAAP reading scores, and 52% of variation in CAAP science reasoning scores were accounted for by the corresponding ACT scores.

The study found that CAAP scores were not nearly as correlated with cumulative GPA's as they were with ACT scores. Even though there was a significant amount of correlation between CAAP scores and cumulative GPA's, the amounts were moderate at best, ranging from .4 to .5. Predictability was also weaker when estimating CAAP scores based solely on cumulative GPA's. In fact, cumulative GPA's only accounted for modest proportions of changes in CAAP scores (26% for writing skills, 18% for mathematics, 16% for reading, and 19% for science reasoning).

The study found that the combined forces of the two independent variables (ACT scores and cumulative GPA's) accounted for the following proportions of variations in CAAP scores: 64% for writing skills, 38% for mathematics, 58% for reading, and 58% for science reasoning. The ACT score was consistently a more significant predictor than was the cumulative GPA.

The specific purpose of Arkansas Act 874 of 1993 was to " . . . evaluate student learning in the general education curriculum . . ." While the CAAP as used in Arkansas does provide a measure of learning in four general education areas (writing skills,

mathematics, reading, and science reasoning), it is unclear whether the measure can be attributable to the treatment (45-60 hours of college class work) or to one or more extraneous factors including intelligence, ability or inability to perform well on standardized tests, excellent or poor secondary college preparation, and attitude on the text.

This study has shown a distinct correlation between ACT scores and CAAP scores. Even though it is statistically possible to compare and correlate ACT scores and CAAP scores, it would seem more practical to use the CAAP as a pretest and as a posttest. If this were done, any differences in the results, hopefully positive differences, could be credited to the treatment.

As stated in the introduction, the student's reward for taking the examination is a statement posted on his/her transcript that the testing requirement has been met. This leaves open the possibility that students may not have the motivation necessary to perform at an optimum level. For the CAAP to be a true measure, students who take this test should do their very best in both the pretest and posttest situations. Students would need to be highly motivated at both points. While the imposition of cut-off scores to enter or continue in a state-supported institution of higher learning is unpleasant, this action might have the greatest chance of telling the state what it wants to know; i.e., how much have students learned in the general education curriculum?

If the CAAP were used as both a pretest and posttest, it would provide some equality among institutions. Some students are well prepared; obviously, others are less prepared and perhaps even poorly prepared to deal with postsecondary work. Changes in CAAP performance could be ascribed to improvement or achievement since entry into

the institution. Open-admissions universities, such as the University of Arkansas at Monticello, that accept poorly prepared students have much less chance of exceeding national averages in at least three of the four test areas, which was one criterion to be met to receive productivity funding. However, if incentive funding were based solely on positive changes between CAAP pretest and CAAP posttest, each institution could participate on merit. Those which bring the students the farthest during the 45-60 hours would reap the greatest benefits.

The alternative to cut-off scores would be a reward system. If the state could afford to do so, it might offer scholarships or other monetary incentives to students who show the largest gains between pretest and posttest. Emphasis would need to be placed on the phrase "gains between pretest and posttest" to enable more than just the top scorers to share in the spoils.

The conclusions and recommendations made are based on a very limited study of 124 students from a small rural university. A final recommendation is to replicate this study with larger institutions to see if the findings from this University are consistent with those from larger institutions or if the findings of this study were unique in some way.

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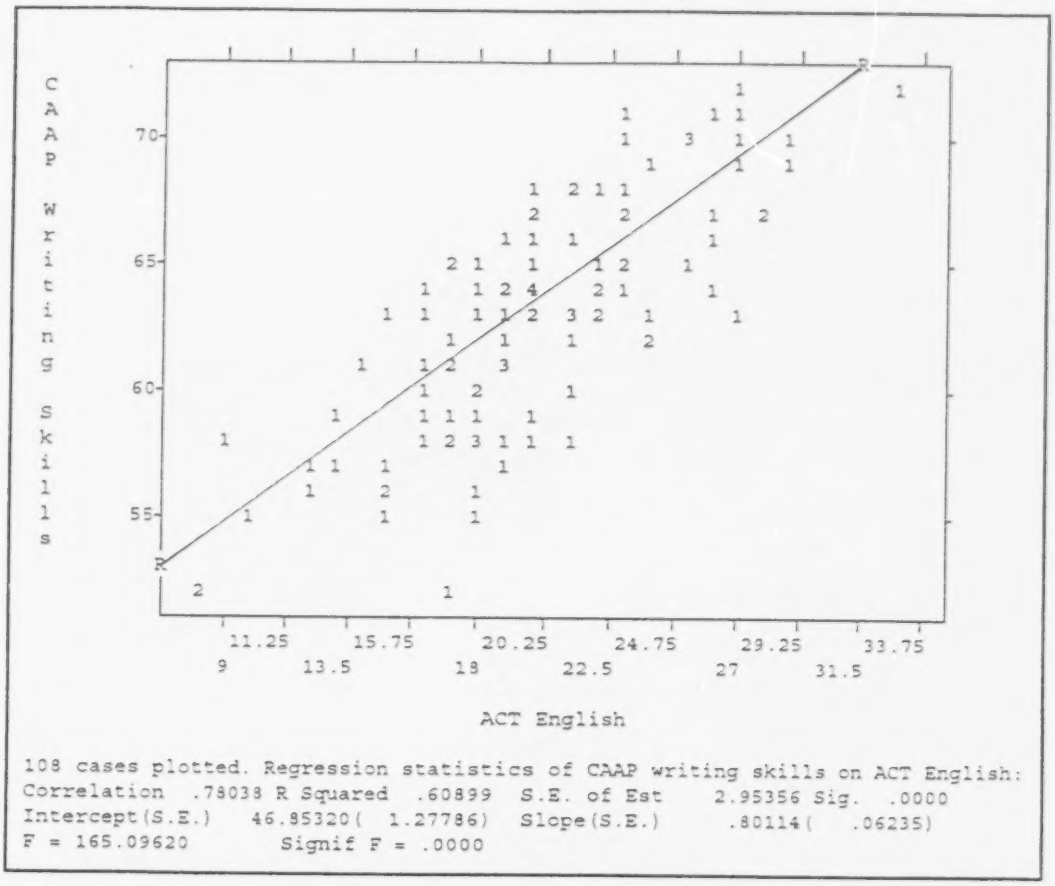

Figure I
Regression plot of CAAP writing skills scores and ACT English scores.

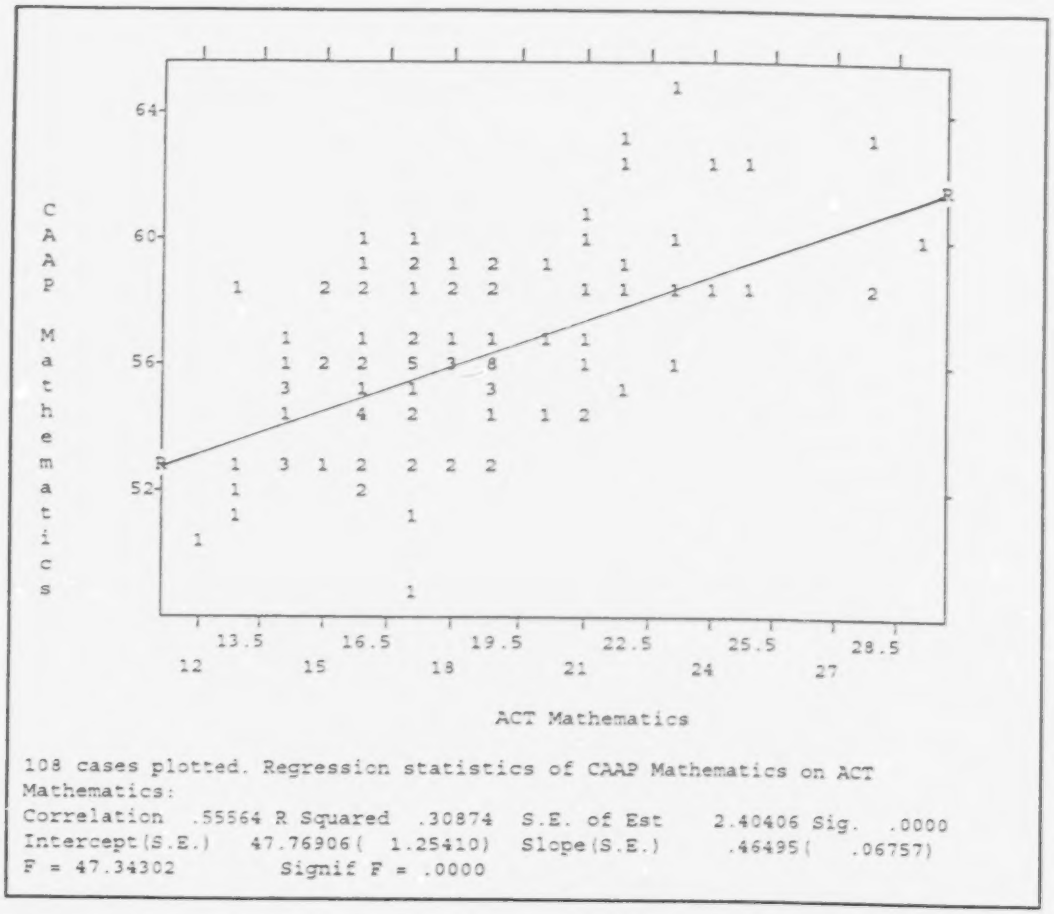

Figure II
Regression plot of CAAP mathematics scores and ACT mathematics scores.

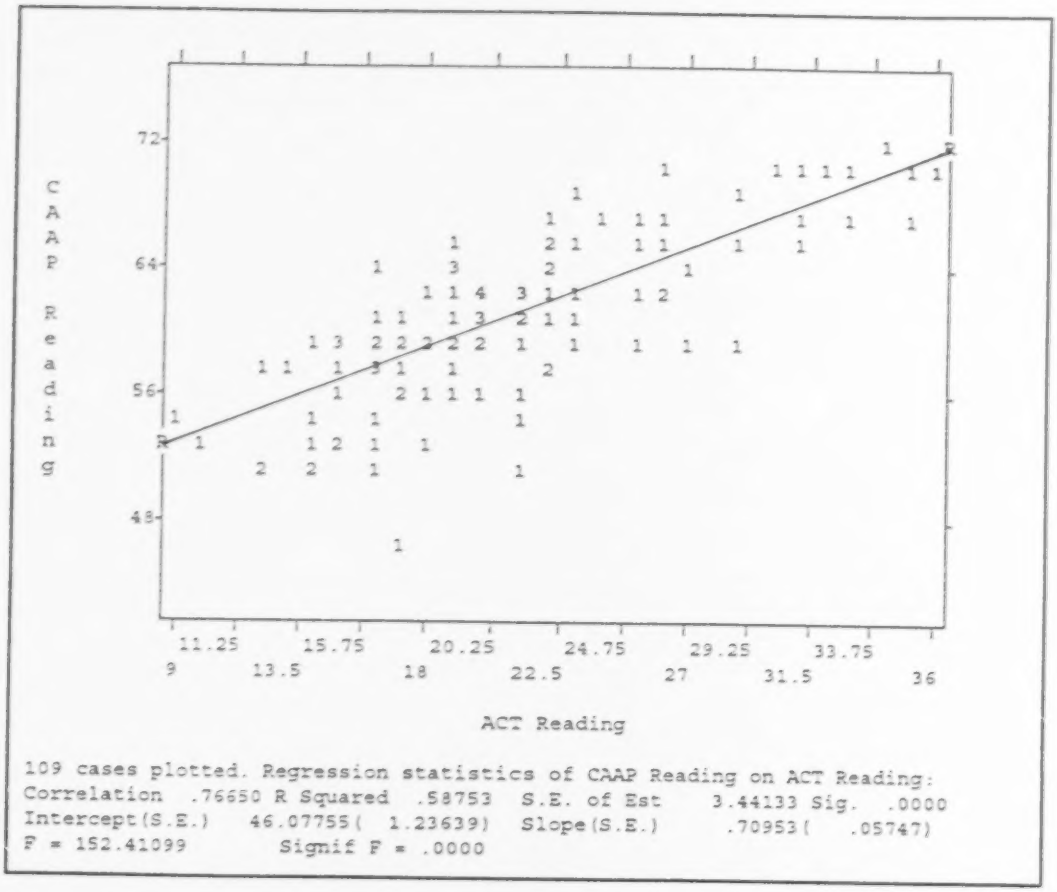

Figure III
Regression plot of CAAP reading scores and ACT reading scores.

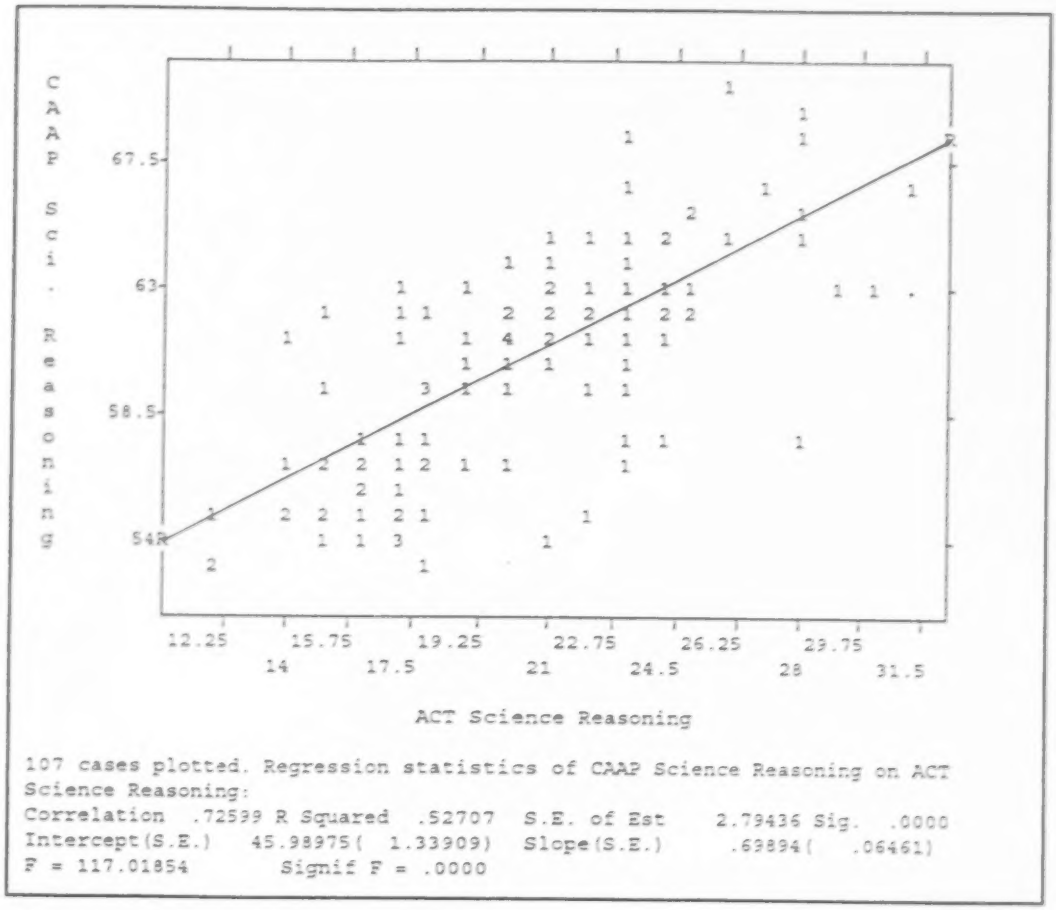

Figure IV
Regression plot of CAAP science reasoning scores and ACT science reasoning scores.

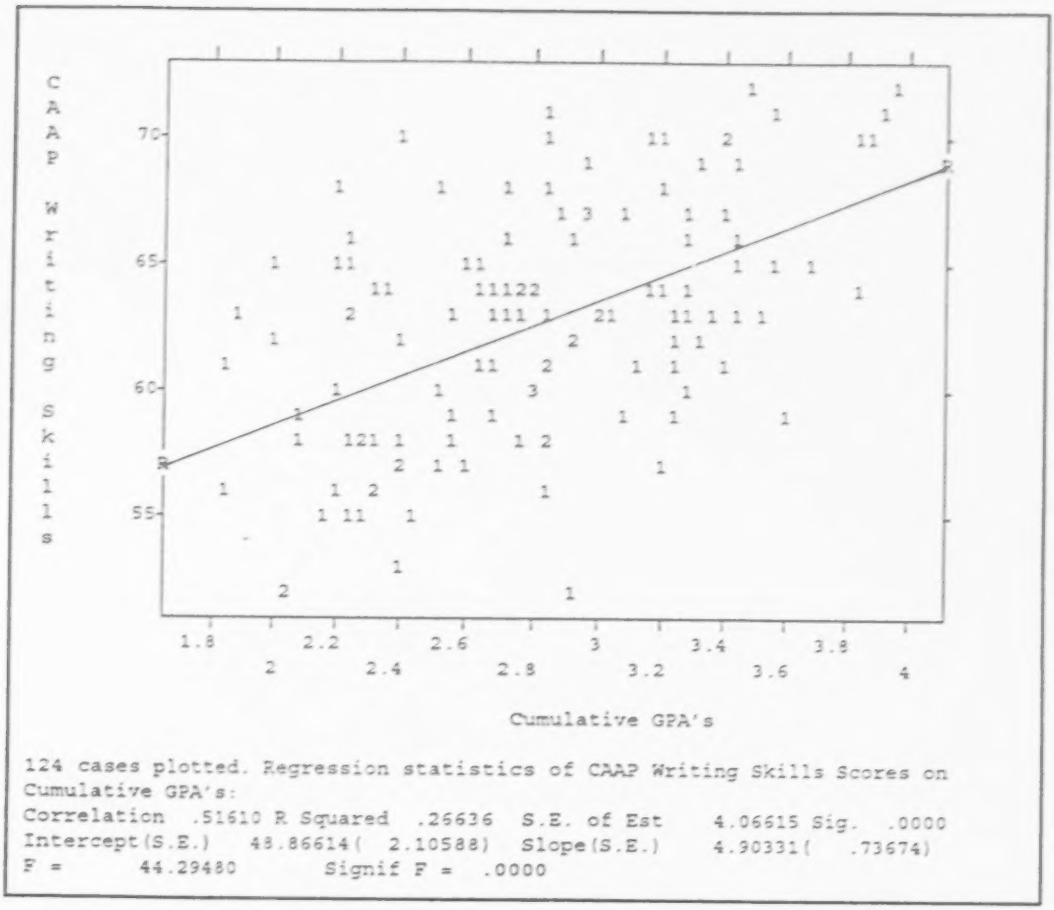

Figure V
Regression plot of CAAP writing skills scores and cumulative GPA's.

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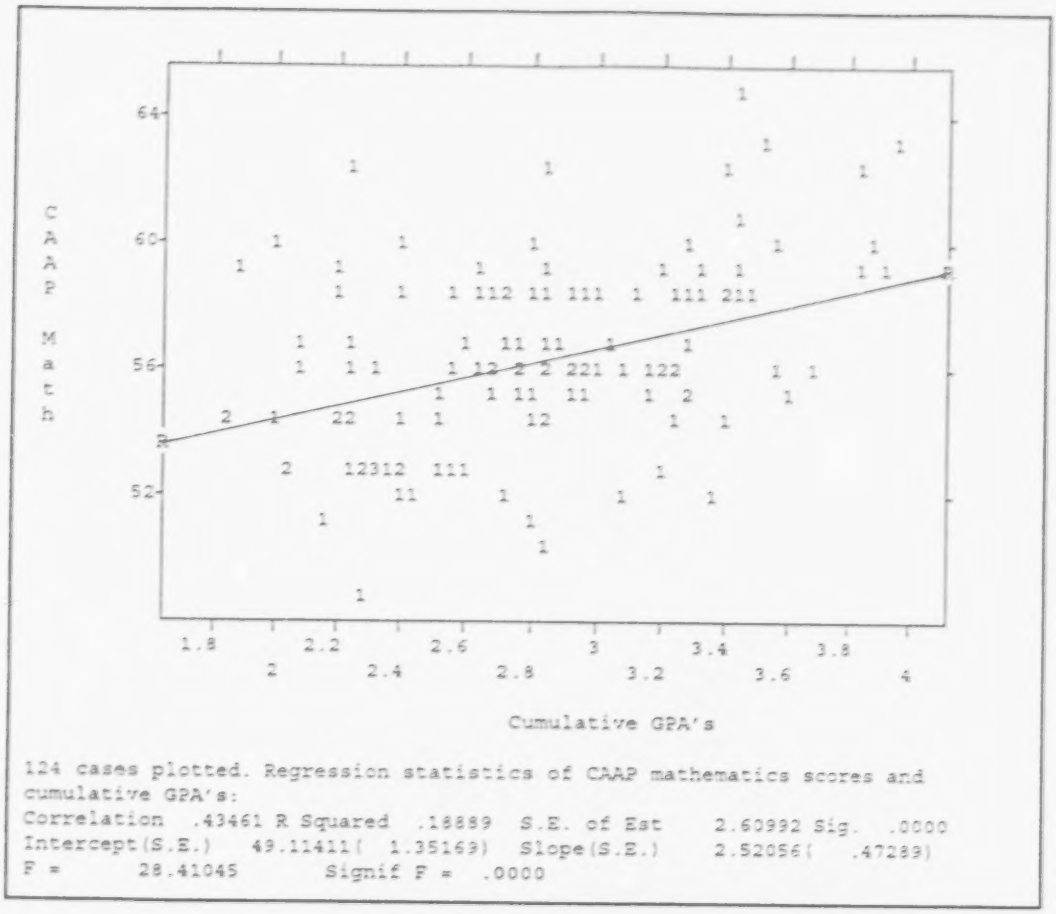

Figure VI
Regression plot of CAAP mathematics scores and cumulative GPA's.

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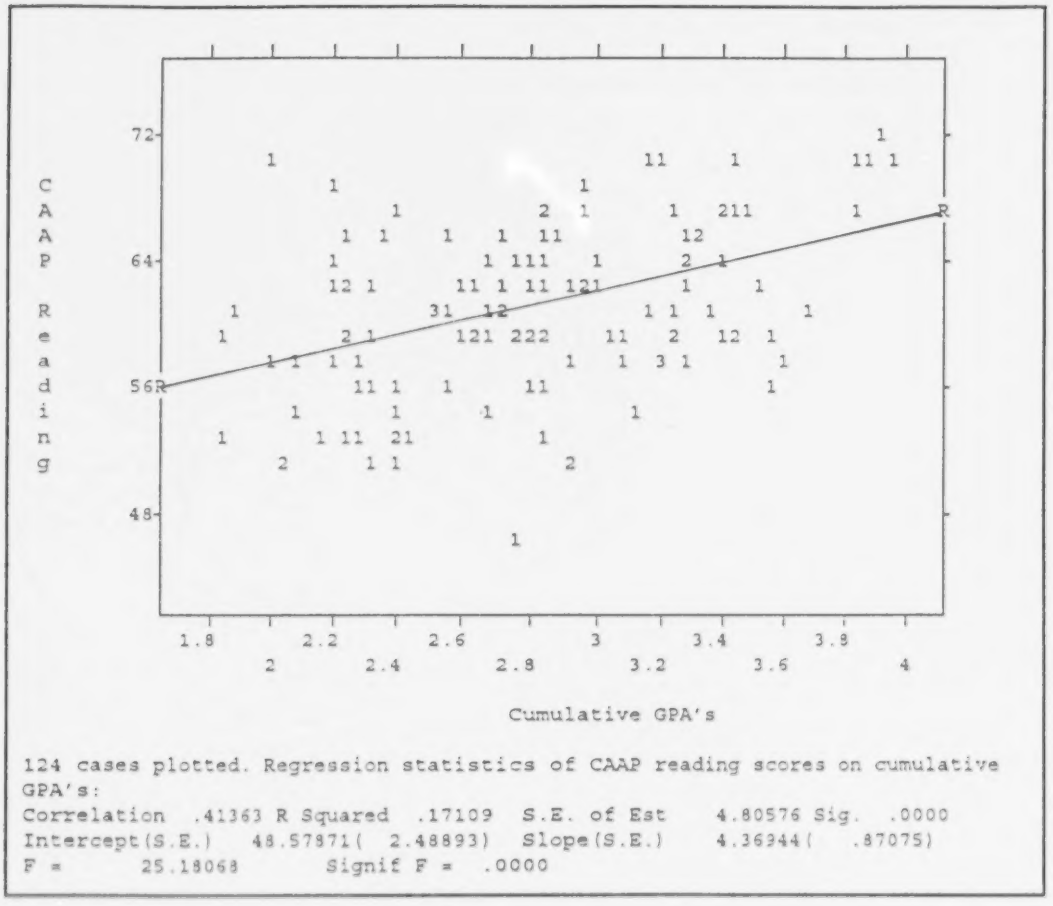

Figure VII
Regression plot of CAAP reading scores and cumulative GPA's.

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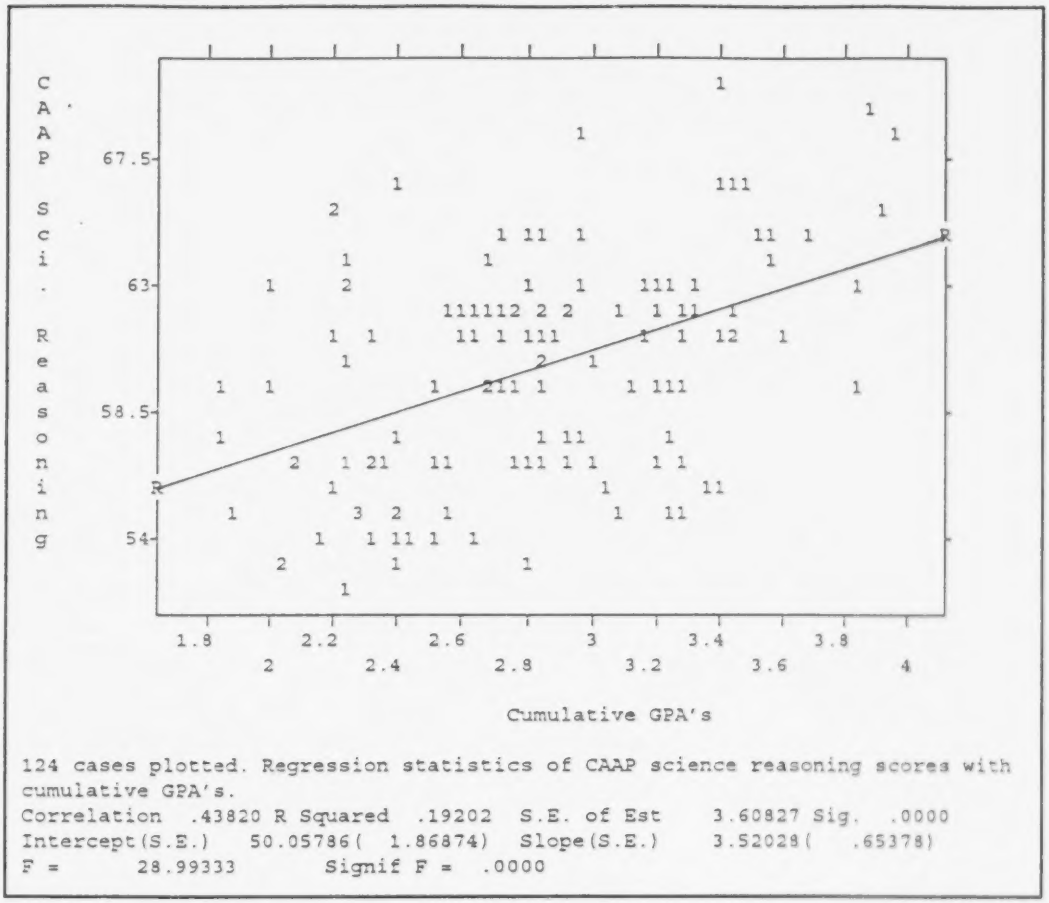

Figure VIII
Regression plot of CAAP science reasoning scores and cumulative GPA's.

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